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The role of Brazil in the world orange juice market: a threat posed by CVC

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Abstract

The role of the processed citrus industry of Brazil, the largest world orange juice producer, is discussed with reference to CVC (citrus variegated chlorosis), a bacterial disease that affects one-third of the Brazilian tree inventory. Scenarios are analyzed via a spatial equilibrium model on the impact of increased/decreased CVC incidence.

Key words: *Brazil, CVC, orange juice, Xylella.*

1. Introduction

In Brazil, citrus is concentrated in the state of São Paulo, which represents nearly 85 percent of Brazilian production and virtually all the Brazilian FCOJ (frozen concentrated orange juice) exports.

The São Paulo citrus industry in Brazil is considered to employ 400,000 people and to export US$ 1.3 billion in juice, FCOJ mostly, fresh orange, pulp pellets and essential oils in 1999. (Neves et al.)

While oranges are produced in many countries with tropical or subtropical climates, the processed orange industries of Florida and São Paulo dominate the world market for orange juice. These two states produce more than 80 percent of the orange juice consumed in the world, 37 per cent and 48 per cent, respectively. (FAO)

Unlike Florida, São Paulo is the only major orange producing region in the world affected by CVC (citrus variegated chlorosis), a bacterial disease present in one-third of the orange trees in Brazil (Fundecitrus). Much research and investment has been focused on sequencing and analyzing the causal bacterium of CVC, *Xylella fastidiosa*, in Brazil in an attempt to find a cure for the disease. So far, São Paulo has lived with CVC by adopting the following measures of control: pruning of affected branches, spraying of vectors and production of seedlings in greenhouses, all of which have likely increased the cost of production.

The economic importance of CVC is uncontestable: in 2000, losses were estimated at US$ 250 million (Fundecitrus). Across all sweet orange varieties grown in Brazil, production losses are found in plants with severe symptoms, such as reduction in the size and weight of fruits. It has been estimated that the production decrease in highly affected trees is about 75 percent when compared to the healthy ones. (Ayres) Therefore, on the supply side, CVC represents a prominent threat to the leading role that Brazil plays in the world orange juice market.

This paper, thus, analyzes the aforementioned threat in the context of a mathematical programming model of the world orange juice market (McClain). Scenarios are analyzed via a spatial equilibrium model on the impact of increased/decreased CVC incidence, focusing not only on the modeling but also on the issue and its results and implications.

2. Recent Events

2.1. An Overview of Citrus Production in São Paulo

The processed orange industry of São Paulo (including the south of Minas Gerais state), Brazil, together with Florida, United States dominates the world market for orange juice.

The processed orange juice industry in São Paulo, Brazil had its origins in the early 1960's as a result of a freeze that damaged Florida orange groves in 1962. Due to the need to find another production area for oranges in order to meet the growing market in North America, São Paulo arose as an investment opportunity for orange juice processors and exporters. Lykes-Pasco, a large integrated grower-processor in Florida, entered São Paulo and formed Citrosuco in a joint venture with the German-Brazilian group Fischer. Orange juice exports from Brazil grew from 5,313 MT of FCOJ in 1963-64 to almost 1.3 million MT in 1999-00 as shown in Figure 1. FCOJ produced in São Paulo is responsible for 98 percent of the total FCOJ produced in Brazil. (Abecitrus)

Helped again by a series of freezes in Florida in the 1980's, the São Paulo citrus industry received another thrust and grew even more. The citrus commercial area expanded further north in São Paulo and established in the southern extreme of Minas Gerais state. Northern São Paulo state and Minas Gerais have a drier and warmer winter, more tropical. Besides the weather effect, growing in a rapid and disorganized fashion, without much control on new

planting materials, in 1987 the first occurrence of the disease in a commercial grove in northern São Paulo was observed. Over the decade of 1990's, the disease spread throughout the citrus industry in São Paulo and now is present in one-third of the tree inventory. Every year, six million bearing trees become unproductive due to the severe symptoms caused by the bacterium.

Currently, there is no cure for CVC, caused by *Xylella fastidiosa* (Chang et al.). This way, São Paulo has lived with CVC through pruning affected branches, spraying against vectors (sharpshooters), and producing seedlings in greenhouses, which have increased the cost of production by 10 percent or so according to industry sources.

The Brazilian citrus industry is in the middle of a transitory moment, in which research on ways of controlling the bacterium and creating plants resistant to it is conducted while the tree inventory is being renovated by seedlings grown in greenhouses and a new technological paradigm is established, as a consequence of institutional changes.

Production losses in plants showing severe symptoms, such as reduction in the size and weight of fruits, are about 75 percent when compared to the healthy trees. (Ayres) Therefore, on the supply side, CVC can represent a major threat to the prominent role that Brazil plays in the world orange juice market, limiting its viability.

São Paulo has become the largest citrus production region in the world. The combination of abundant land, good soils, adequate rainfall that is well-distributed, and no threat of freezes has allowed the citrus industry in São Paulo

to exert leadership in world citrus production. Brazil also has a low wage scale that provides low cost unskilled labor for citrus harvesting. The citrus industry has also made major investments in citrus processing as well as investment in transportation to facilitate the export of orange juice to Europe, North America, and the Pacific Rim.

The most important citrus crop produced in São Paulo is round oranges. São Paulo orange production over the period 1979-80 through 2001-02 is shown in Figure 2. Production increased significantly over this period from just over 150 million boxes in 1979-80 and peaking at 420 million boxes in 1997-98. This rapid increase in production was spurred by two primary factors. First, a series of freezes visited Florida and killed millions of trees in the decade of the 1980's. Orange production in Florida decreased from 220 million boxes in 1979-80 to 103 million boxes in the 1989-90 season. World orange prices rose dramatically and significant capital was attracted to orange production. Second, improvements in transportation of FCOJ sharply reduced the cost of delivering orange juice to the developed economies of North America and Europe. Per capita consumption in both markets grew with per capita consumption in the United States approaching six SSE gallons.

By the end of the 1990's, however, production in Florida recovered from the low levels realized after the freezes of the 1980s. Florida orange production was 244 million boxes in 1997-98 and has exceeded 200 million boxes each season since 1999-00. Large crops in both São Paulo and Florida brought

sharply lower prices in the 1999-00 and 2000-01 seasons. Lower prices have curtailed the rate of new plantings as shown in Figure 3.

Orange production in São Paulo is concentrated in the northern half of the state. An outbreak of citrus canker in the 1970's in a production area south of the Tietê River confined citrus production to production north of that river. Nearly all citrus production is in a rainfed system because of lack of surface water and a deep water table. The distribution of rainfall in Brazil is such that a rainfed system is successful in most seasons. Because of its dependence on rainfall for moisture, however, most citrus trees in São Paulo (estimated at 80 percent by private sources) is planted on Rangpur Lime rootstock which is highly tolerant of drought. Rangpur Lime, however, is susceptible to blight, a disease that usually attacks trees in after they reach 10 years of age. By 15 years of age, a large proportion of trees are usually lost to blight, and the grove is replanted.

With the rapid expansion of orange production in the 1980's and early 1990's, orange growers were forced to move into new production areas in extreme northern São Paulo state. New plantings were also found in southern Minas Gerais which lies on the northeast boundary of São Paulo. These production areas are in a more tropical climate with less rainfall.

2.2. Recent Events in the São Paulo Citrus Industry

Two of the most destructive diseases that affect citrus trees, canker and tristeza, have both been found in São Paulo in the past 50 years. As trees

planted on sour orange rootstock are susceptible to the tristeza virus, orange growers reacted by switching to Rangpur Lime and other tristeza rootstocks. After the citrus canker outbreak of the 1970's, orange growers realized that citrus canker is endemic south of the Tietê River and moved their citrus plantings.

In 1986, a new disease surfaced in the northern production areas of São Paulo and southern Minas Gerias. This disease resulted in lesions on the leaves and smaller fruit with greatly reduced juice content. An intensive research effort was initiated funded by Fundecitrus, a research organization funded by citrus growers and processors. In 1989, the disease was identified as citrus variegated chlorosis (CVC). Its vector of spread was a common insect known as a "sharpshooter." There is no treatment to cure CVC, and given the widespread incidence of the sharpshooter, insecticides have only limited success in reducing the spread of CVC.

By 2000, it was clear that CVC has spread beyond the northern production areas and had moved into older production zones near Matão and Araraquara. It is now believed that poor control of new planting material hastened the spread of CVC. With the high rate of replanting in São Paulo, use of diseased trees became another vector of spread.

CVC can only be controlled through severe pruning of affected limbs or tree removal.

Additional spraying may also reduce sharpshooter populations. Therefore São Paulo citrus growers face the prospect of "living with" CVC and must deal with the increased production costs and lower yields associated with CVC.

Fundecitrus estimated that 2001, over 36 percent of all citrus groves in São Paulo show some evidence of CVC, with 24 percent of groves exhibiting “level 2” or a more advanced level of infection.

CVC is also more lethal to young trees, which explains the sharp decrease in the nonbearing tree inventory that occurred over the 1996 through 2000 period. As CVC first appeared in the mid-1980’s, but still not diagnosed, young trees infected with the disease were unknowingly planted close to healthy groves widening the CVC spread.

2.3. Citrus Production with CVC in São Paulo

The citrus industry in São Paulo now accepts the verdict that it will not be able to eradicate CVC and must learn how to manage the disease. A three-pronged approach is being adopted:

1. Beginning January 1, 2003 all new plantings must be done with trees propagated in shaded greenhouses. Production of seedling citrus trees in an open system for commercial sale will be prohibited;
2. Growers will increase scouting to detect CVC infection and aggressively prune diseased branches; and
3. Increased spraying to control sharpshooter populations.

3. Research Question

What is the economic impact of CVC on Brazilian citrus?

1. Reduced production (yields);
2. Increased death loss/tree removals;
3. Increased cultural care costs; and
4. Increased cost of new trees, screen house and regulation.

4. Methodology

It is being written.

This paper, thus, analyzes the aforementioned threat in the context of a mathematical programming model of the world orange juice market (McClain). It is also an opportunity to improve the Brazilian side of the model, as far as equations predicting new plantings in Brazil, ramifications of CVC and interactions with citrus canker and blight, the role of Pêra Rio as a midseason and multiple blooming variety.

1. Partial budgeting to estimate cultural care, replacement tree cost and yield effect on cost per hectare and cost per box; and
2. Adapt a spatial equilibrium model of the world OJ market to estimate market impacts of smaller crops and reduced tree numbers.

5. Analysis

It is being written.

Scenarios are analyzed via a spatial equilibrium model on the impact of increased/decreased CVC incidence, focusing not only on the modeling but also on the issue and its results and implications.

Sensitivity analysis are conducted to identify the conditions that would allow Brazil to continue to be the world's largest exporter of orange juice. Different growth rates scenarios are considered for the spread of CVC as well as for the market for orange juice.

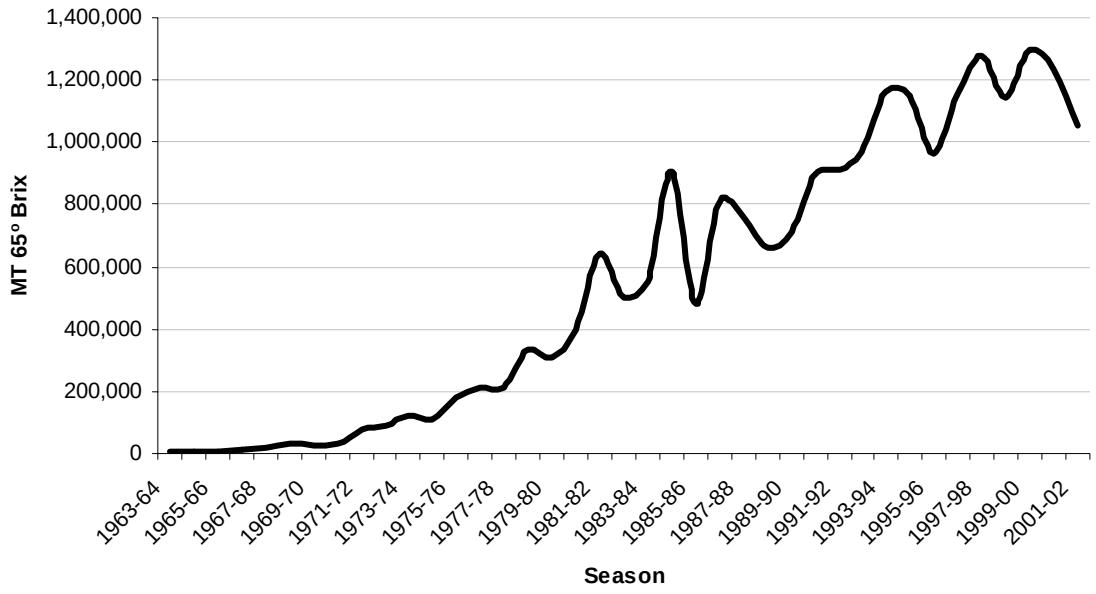
1. The budget; and
2. Go back and project the tree inventory without CVC.

6. Conclusion

It is being written.

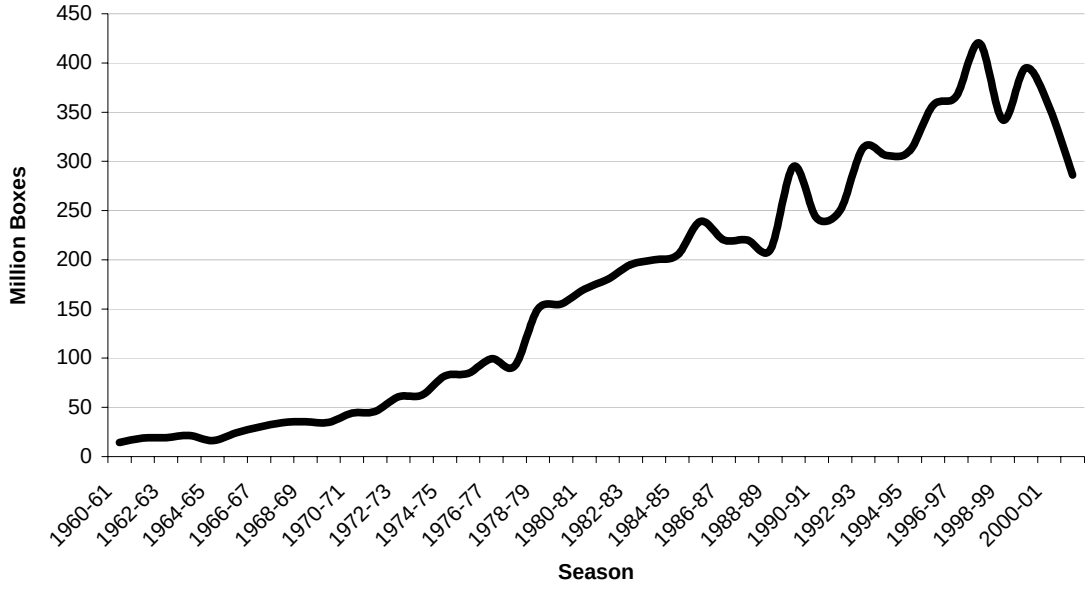
The expected result of the analysis is likely reduced trade in orange juice between Brazil and its consumer markets as CVC grows.

Figure 1. Brazil FCOJ Export



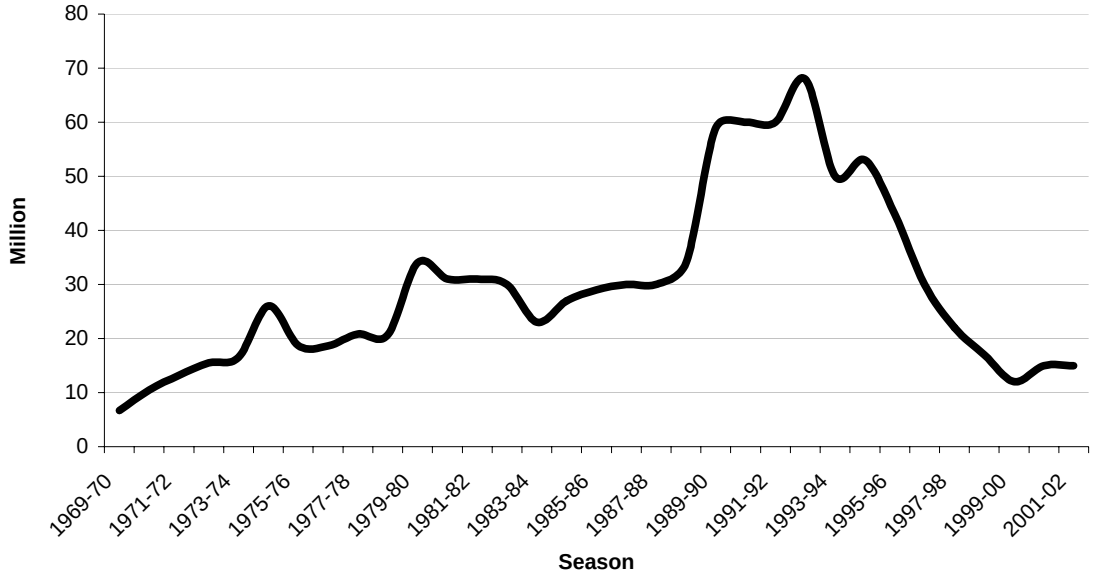
Source: FAS (Foreign Agricultural Service); FDOC (Florida Department of Citrus)

Figure 2. São Paulo Orange Production



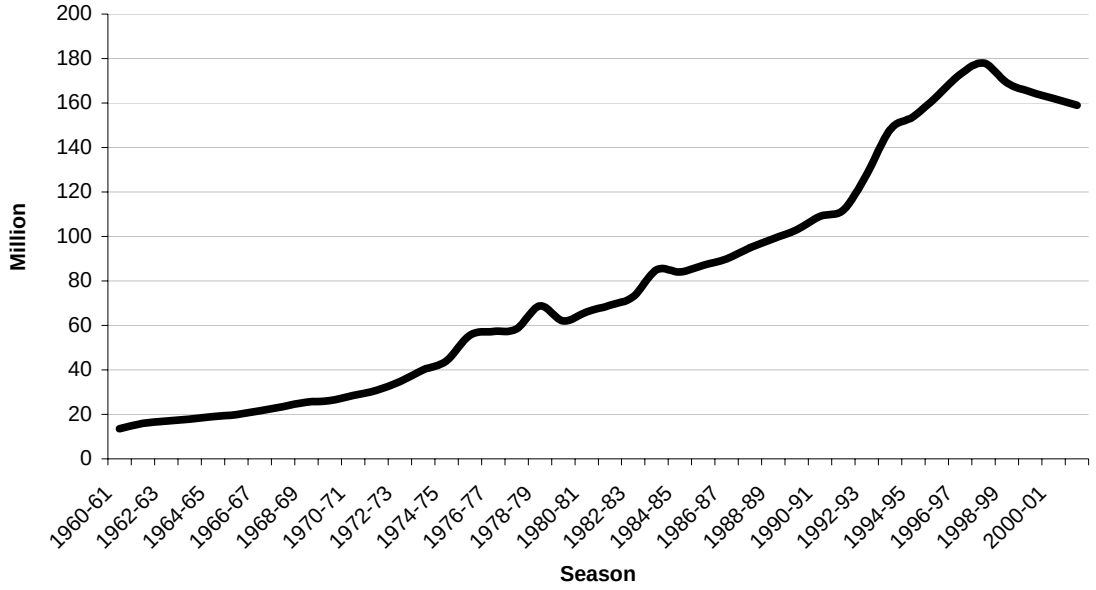
Source: FAS (Foreign Agricultural Service); FDOC (Florida Department of Citrus)

Figure 3. São Paulo Non-Bearing Tree Inventory



Source: FAS (Foreign Agricultural Service); FDOC (Florida Department of Citrus)

Figure 4. São Paulo Bearing Tree Inventory



Source: FAS (Foreign Agricultural Service); FDOC (Florida Department of Citrus)

References

Abecitrus (The Brazilian Association of Citrus Exporters). http://www.abecitrus.com.br

Ayres, Antonio J. [06/2000] *Intensidade da Clorose Variegada dos Citros em Pomares Comerciais de Laranja do Estado de São Paulo e Sul do Triângulo Mineiro*. Dissertação de Mestrado. Jaboticabal: FCAV-UNESP. 59p.

FAO. http://www.fao.org

Fundecitrus. http://www.fundecitrus.com.br

McClain, Emily A. [1989] *A Monte Carlo Simulation Model of the World Orange Juice Market*. Ph.D. dissertation. Gainesville: University of Florida. 159p.

Neves *et alii*. [12/2001] http://www.fruit-processing.com